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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/003,386      | 10/30/2001  | Mun-Mo Jeong         | 9898-188            | 5352             |

7590                    08/14/2002

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| EXAMINER |
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GEBREMARIAM, SAMUEL A

| ART UNIT | PAPER NUMBER |
|----------|--------------|
| 2811     |              |

DATE MAILED: 08/14/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

|                              |                        |   |
|------------------------------|------------------------|---|
| <b>Office Action Summary</b> | <b>Application No.</b> | <b>Applicant(s)</b>   |
|                              | 10/003,386             | JEONG, MUN-MO<br> |
|                              | <b>Examiner</b>        | <b>Art Unit</b>   |
|                              | Samuel A Gebremariam   | 2811  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on 15 July 2002.
- 2a) This action is FINAL.                    2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 1-13 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) Claim(s) \_\_\_\_\_ is/are allowed.
- 6) Claim(s) 1-13 is/are rejected.
- 7) Claim(s) \_\_\_\_\_ is/are objected to.
- 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on \_\_\_\_\_ is/are: a) accepted or b) objected to by the Examiner.  
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) The proposed drawing correction filed on \_\_\_\_\_ is: a) approved b) disapproved by the Examiner.  
 If approved, corrected drawings are required in reply to this Office action.
- 12) The oath or declaration is objected to by the Examiner.

#### Priority under 35 U.S.C. §§ 119 and 120

- 13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
 a) All    b) Some \* c) None of:  
 1.) Certified copies of the priority documents have been received.  
 2.) Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
 3.) Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
 \* See the attached detailed Office action for a list of the certified copies not received.
- 14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
 a) The translation of the foreign language provisional application has been received.
- 15) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                           | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2 . | 6) <input type="checkbox"/> Other: _____                                    |

## DETAILED ACTION

### ***Election/Restrictions***

1. Applicant's election without traverse of group I, claims 1-13 of drawn to a method making semiconductor device in Paper No. 5 is acknowledged.

### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-13, are rejected under 35 U.S.C. 103(a) as being unpatentable over Maniar et al., US patent No. 5,702,981.

Regarding claim 1, Maniar teaches (figs. 2-6) a method for manufacturing a semiconductor device comprising: sequentially forming an interconnection layer 36, a capping layer 38, and an etching stopper 40 on a semiconductor substrate 32; forming an interlayer insulating layer 42 having a first contact hole 44 exposing a surface of the etching stopper formed of a material having a high etching selectivity with respect to the interlayer insulating layer; forming a second contact hole to substantially expose a top surface of the capping layer by removing a portion of the etching stopper exposed by the first contact hole; and forming a conductive layer 52 within the second contact hole.

Maniar does not explicitly states that he forms first and second contacts holes. It is evident from figures 3 and 4 that Maniar first forms contact hole 44 by first exposing the etching stopper layer and finally the exposing the capping layer 38. Maniar also

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suggests that the capping layer maybe removed during the removal the etching stopper layer due to prolonged etching. This would lead layer 36 be exposed till the barrier layers 50 are formed.

Since the capping layer 38 and the barrier layer are the same and the serve the same purpose of protecting the interconnection layer 36 it would have been obvious to one of ordinary skill in the art at the time the invention was made to leave capping layer from the first deposition instead of etching the layer and re-depositing it in order to save manufacturing time.

Regarding claim 2, Maniar teaches substantially the entire claimed method of claim 1 above including the method of claim 1 further comprising forming a third contact hole by slightly etching a portion of the capping layer exposed by the second contact hole before forming a conductive layer, and wherein the conductive layer is formed within the second contact hole and the third contact hole (fig. 6).

Maniar does not explicitly teach a third contact hole is formed by slightly etching portion of the capping as claimed. As can be seen from figure 5 the thickness of layer 38 that is left unetched is more than the newly formed barrier layer 50. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to partially etch the portion that is needed in order to cut on the processing time.

Regarding claim 3, Maniar teaches substantially the entire claimed method of claim 1 above including the conductive layer is formed only in the second and third contact holes (fig. 6).

Regarding claim 4, Maniar teaches substantially the entire claimed method of claim 1 above including the conductive layer is an upper interconnection layer filling the second and third contact holes and covering the top surface of the interlayer-insulating layer (fig. 5).

Regarding claim 5, Maniar teaches substantially the entire claimed method of claim 1 above including the second and third contact holes are formed by performing a dry etching method using an etchant having a low etching selectivity between the etching stopper and the capping layer (col. 4, line 49-, col. 6, line 24).

Regarding claim 6, Maniar teaches substantially the entire claimed method of claim 1 above including the etching stopper is formed of an inorganic anti-reflecting layer (ARL) that is silicon nitride or aluminum nitride (col. 4, line 45-64).

Regarding claim 7, Maniar teaches substantially the entire claimed method of claim 1 above including the interconnection layer is a metal layer containing aluminum (col. 4, line 1-26).

Regarding claim 8, Maniar teaches substantially the entire claimed method of claim 1 above including the capping layer is formed of TiN (col. 4, line 1-26).

Regarding claim 9, Maniar teaches substantially the entire claimed method of claim 1 above including the interlayer insulating layer is formed of one selected from the group consisting of a silicon oxide layer, borophosphosilicate glass (BPSG), phosphosilicate glass (PSG), tetraethylorthosilicate (TEOS) (col. 4, line 65-, col. 5, line 9).

Regarding claim 10, Maniar teaches substantially the entire claimed method of claim 1 above including the interconnection layer, the capping layer, and the etching stopper are formed by sequentially depositing material layers for forming the interconnection layer, the capping layer, and the etching stopper, and patterning the material layers by the same etching process (col. 6, line 5-24).

Regarding claim 11, Maniar teaches substantially the entire claimed method of claim 1 above including the conductive layer is formed only in the second contact hole (fig. 6).

Regarding claim 12, Maniar teaches substantially the entire claimed method of claim 1 above including the conductive layer is an upper interconnection layer filling the second contact hole and covering the top surface of the interlayer insulating layer (fig. 5).

Regarding claim 13, Maniar teaches substantially the entire claimed method of claim 1 above including the first contact hole is formed by using a dry etching method (col. 6, line 5-24).

### ***Conclusion***

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. References A-E are cited as being related to interconnection structures.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Samuel Admassu Gebremariam whose telephone number is 703 305 1913. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Samuel Admassu Gebremariam  
August 11, 2002

Steven Lake  
Primary Examiner

